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The effect of the Common Agricultural Policy Reforms on farmer intentions towards food production: evidence from livestock farmers

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Highlights

Responses to previous policy reform is a strong predictor of future intentions

The majority of farmers seek no changes in their business up to 2020

Decrease in subsidies will have a greater effect than an increase in payment

Path dependency should be explored further in intentions studies

1.0 Introduction

From its inception in the 1950s, the Common Agricultural Policy (CAP) has experienced a series of reforms, initially progressing along a pathway of support for output expansion (Skogstad and Verdun, 2009; Burrell, 2009), in order to address food security issues arising from the Second World War. However, by the 1980s, European production was no longer characterised by a deficit in food production, and the negative environmental and economic impacts of the production surplus were being recognised (Commission of the European Communities, 1991). Subsequent reforms have shifted policy away from direct production supports. The "MacSharry Reforms" in the early 1990s replaced price supports with direct aid payments to farmers. New policies continued to provide substantial payments to farmers, but shifted in emphasis towards food quality, supporting farm diversification and environmental maintenance. In 2003, the "Fischler Reform" represented a far more radical shift (Swinnen, 2010), decoupling a large share of the CAP from production into a 'single farm payment' (SFP), and introducing modulation (where funds were shifted towards rural development) and cross compliance (where only farmers adhering to a set regulations relating to the environment, animal welfare, livestock identification and traceability, plant protection and food safety were eligible to receive the SFP). Further reforms in 2015 have continued to separate farm payments from production, with the addition of new 'greening requirements'. Over this time period, while the budget for the CAP rose (reflecting the increasing number of European states), in real terms, the funding available at national levels and thus also to individual farms has declined (European Commission, 2015). The purpose of this paper is to explore the influence of recent CAP reforms, particularly potential changes to individual payments, on UK farming trajectories.

The changing trajectories of European farms, in response to policy and other shifts, has been a popular topic of research. In the 1980s and early 1990s, the potential for differential development of farms, conceptualised as 'farm adjustment strategies' was explored within modified political economy frameworks (Evans, 2009). Bowler (1992) is perhaps best known for identifying a range of possible farming trajectories, building on a typology by Whatmore *et al.* (1987). These seven 'paths of farm business development' included intensification and specialization, recombination of farm resources into new enterprises and products on and off the farm, maintaining a traditional model of farming, winding down into hobby or semi-retirement, and retirement from farming altogether.

The farm adjustment literature was largely subsumed within the post-productivist and multifunctional agricultural literature of the 1990s and 2000s, which focused on assessing policy shifts away from production (Marsden and Sonnino, 2008), and seeking evidence for related transitions at farm level (Gorton *et al*., 2008; Walford *et al*., 2003; Wilson, 2001). More recently, this discourse has shifted towards 'neo-productivism', a political discourse oriented towards addressing world hunger through increased production (Brunori *et al*., 2013; Burton and Wilson, 2015). In general, empirical studies have found that European farmers retained a strong cultural orientation towards production-oriented agriculture (Burton, 2004; Gorton *et al.*, 2008). At the same time, the differential behaviour of farms were recognised in a growing number of farm typologies (e.g. Barnes *et al*., 2011; Bohnet, 2008; Davies and Hodge, 2007; Garforth and Rehman, 2006; Gorton *et al*., 2008). These typologies generally assumed path dependence (i.e. that farms would continue along their established trajectories). Farmers have a range of management options which may constrain or steer them away from the present farming business environment,

referred to as path dependency (Brian 1994; David, 1985). In addition, there are strong cultural orientations embedded in farming, which support the continuation of production-oriented farming practices in particular (Gray, 1998; Burton, 2004, Burton *et al.*, 2008).

Recent work has introduced approaches for understanding major transitions at farm level. Wilson (2007) argued that transition is non-linear, heterogeneous, complex and inconsistent, and therefore somewhat unpredictable. His conceptualisation emphasised key nodal turning points. Sutherland *et al.* (2012) proposed an alternative perspective based on empirical research, which similarly identified major transition processes, but found a smoother level of transition, following 'trigger points' in the farm life cycle where farmers were particularly open to changing trajectory. Both were consistent in arguing that farm decision-making is path dependent, but that these pathways were not inevitable: new directions can be adopted under particular conditions, but these remain heavily impacted upon by previous decisions and information held within the farming family, as well as the opportunities present in the structure of the farm and farm household. Major changes in farm profitability and subsidy access were included in their list of possible triggers and nodal points for these major change processes.

In this paper we focus on the changes to production and land use in response to CAP reforms[1]. Releasing farmers from the requirement to produce led to a range of studies focused on the possible response of farmers (Rickard, 2004; Tranter *et al.*, 2007; Sorrentino *et al*., 2011), with the emphasis on their intentions to reduce agricultural production (Gorton *et al*., 2008; SAC, 2008) or to exit from the industry itself (Breen *et al*., 2005; Bougherara and Latruffe, 2010). Generally these studies

[1] Farm diversification is the subject of a separate paper based on this dataset.

find a strong influence from the CAP on determining activity levels within the industry. This is not surprising given the high average proportion of total farm income which comes from EU support (European Commission, 2014). Accordingly, uncertainty from the reform process and future payment rates have been found to affect decision-making (Dibden and Cocklin, 2005; Lobley and Butler, 2010).

Dissociating the full consequence of CAP reforms from other decision-making influences represents a substantial challenge. Farmer decision-making is complex: affected by the whole spectrum of external and internalised social norms, information provision and regulation (Beal 1996; Hardaker *et al*., 1997; Ahearn *et al.*, 2005; Harrington, 2005; Gallerani *et al*., 2008; Viaggi *et al*., 2011) and must respond to uncertainties centred on the weather, economic shocks and disease management priorities (Binswanger and Sillus, 1983; Backus *et al*., 1997; Smit and Skinner, 2010; Barnes and Toma, 2012; Islam *et al*., 2013). Nested within these uncertainties is the influence of direct support payments on shifting farm planning pathways. Nevertheless, over the last decade reforms have led to fundamental shifts in the way that funding is administered and the recent reforms represent a significant change to CAP payments. Uncertainties of policy reform must be disentangled from external and internal influences which affect farmer decision-making.

Previous studies have attempted to measure farmer-stated intentions under future and recent reform of the CAP (Tranter *et al*., 2007; Gorton *et al.,* 2008; Lobley and Butler, 2010; Morgan-Davis *et al*., 2012; Latruffe *et al*., 2013; Raggi *et al.,* 2013). These have been survey based and tended to focus on present and future pressures on the industry. Consequently, agricultural intentions will infer individual farmer pathways and provide a link to the heterogeneous factors which are specific to farmer decision-making. These intentions can focus on increasing intensity or

100 expanding present agricultural activity (Breen *et al*., 2005; Brady *et al*., 2009;
101 Bougherara and Latruffe, 2010; Viaggi *et al*., 2013; Latruffe *et al*., 2013), extensifying
102 agricultural land for the generation of other ecosystem services (Schmid and
103 Sinabell, 2003; Schmid *et al*., 2007; Bartolini and Viaggi, 2013; Ribeiro *et al*., 2014),
104 or even withdrawal from agricultural or land based activity itself (Gallerani *et al*.,
105 2008; Brady *et al*., 2009; Mishra et al., 2010; Latruffe et al., 2013; Viaggi et al.,
106 2013). A series of studies have also examined the intentions related to diversifying
107 agricultural and non-agricultural activities (Lobley and Potter, 2004; Meert *et al*.,
108 2005). To maintain focus and for brevity within this paper we concentrate on
109 intentions to increase or decrease agricultural production activity.

110 There is only a limited amount of literature which has aligned specific CAP policy
111 reform to future intentions and this focuses on the decoupling of payments under the
112 Fischler Reforms in 2003 (Breen *et al*., 2005; Gorton *et al.*, 2008; Lobley and Butler,
113 2010). However, the reform of the CAP will influence farmer decision making. The
114 possible changing levels of subsidy payment from reform will affect farming
115 intentions and this has tended to remain the domain of economic modelling (e.g.
116 Moss *et al*., 2002; Breen *et al*., 2005) with only a few studies using survey based
117 methods to understand response to extreme payment scenarios, such as complete
118 removal of CAP payments (Latruffe *et al*., 2013; Giannoccaro and Berbel, 2013).
119 Latruffe *et al.* (2013) admit that removal of subsidies is a somewhat unlikely scenario
120 in the short and medium term for the CAP. Nevertheless, reform will result in a
121 change to the total amount of direct payment (positively or negatively, on a case by
122 case basis), rather than complete removal of support per se.

123 Payments from subsidy will also have an historic 'lock-in' effect on determining future
124 decision making. For example Gorton *et al*. (2008) offer evidence from follow-up

surveys, where actual behaviour matches farmer stated intentions. Accordingly, following the discussion above concerning farm pathways, we would expect responses to past reform to be a predictor of future intentions, as this reflects some form of policy 'lock-in' (Kay, 2003; Wilson, 2008; Sutherland *et al*., 2012). Testing these effects is noticeably absent from the previous literature and this paper extends this by testing the influence of past reform on future intentions.

In this research we utilise a case study of Scotland, within the United Kingdom. In 2005 Scotland opted for a historically based SFP, with area based entitlement value determined by average subsidy levels from 2001-2003. Scotland is shifting to an area based system under the 2015 reforms, based on land quality criteria. With an introduction of single regional payment rates by 2019, intensive farmers would expect a decline in payment rates. In addition within the livestock sector some coupling remained in the 2003 reforms within the beef sector through a Voluntary Coupled Scheme (VCS) in 2015 this also extends this to the sheep sector in the very extensively farmed rough grazing region. As such the 2015 round of CAP reforms are set to have a greater impact on payment levels to individual farms than the introduction of the SFP in 2005. Support payments are a significant part of the Scottish livestock sector as incomes, without subsidy, are historically negative. Typically, subsidy levels are around the same as the value of output recorded on Scottish livestock farms (Scottish Government, 2014). Consequently changes in the payment regime and the associated rules, relating to cross-compliance, dictate the pathways under which these farmers can operate and will add to the uncertainties within the farmer planning process.

The next section outlines the survey instrument, the data collected and describes the analysis method chosen. This is applied to the case of livestock farmers within Scotland.

2.0 Data and methods

2.1. Data

A telephone-based survey of Scottish agricultural holdings was conducted over the summer of 2013. A spatially representative sample of 10,000 holdings was selected using information from the June Agricultural Survey (JAS) on region, activity, size and farming enterprise. For a large scale survey this data source is the most appropriate as it gives national level coverage and detailed information on activity for ensuring representativeness, however, like most Government agricultural data, it has limits in terms of minimum size requirements of holding represented (Scottish Government, 2012). Business holdings with less than 0.5 standard labour requirements are under-represented within the JAS.

Whilst this under representation of 'very very small' holdings does not historically reflect those affected by CAP payment regimes, some reform scenarios for the 2014-2020 period have proposed extending the criteria for eligibility to include these smaller units (European Commission, 2013). Consequently, whilst we are confident that we can capture the majority of producer intentions, there may be some bias with respect to under representation from farms classified as 'very very small'. Notably, inclusion of these marginal units is also a wider issue for Government and European data collection agencies were the CAP to increase eligibility for these holdings. Only those farms registered as specialist livestock types using the standard farm type

classifications, namely: ‘Specialist Dairy’, ‘LFA Cattle and Sheep’, ‘Lowland Cattle’, ‘LFA Sheep’ and ‘LFA Cattle’ were chosen for this analysis.

The questionnaire contained a number of sections designed to elicit intentions, understand past behaviour and the influences on these intentions up to 2020. The questionnaire had three main sections, namely:

i) the socio-economic and demographic characteristics of the farmer;

ii) changes to the farm since 2005 and perceptions towards the ease of changing the farm; and

iii) proposed intentions for the farm up to 2020.

The study period for changes begins in 2005 to reflect the implementation of the Fischler Reforms and the shift towards historic payments. Hence, it provides a convenient base period for understanding change to past reform but also would be a reference point for farmers who may have adjusted their strategies to accommodate these changes in payment requirements.

We focus on the main agricultural and structural activities within the farming sphere. These are the intentions to increase or decrease agricultural intensity, size of the herd or the business, the level of family or regular employed labour, decisions related to renting more or less land, or exiting farming. Farmers were asked along a 3 point scale whether they intended to decrease, increase or remain stable in terms of these activities. The question related to the intention to exit the business by 2020 was a yes/no binary question.

Intentions were elicited under various scenarios up to 2020, for farmers to consider. Farmers were initially asked their intentions up to 2020, assuming present economic and policy conditions, including commodity prices and costs, and the continuation of CAP Pillar 1 payments were at the same level as 2013. This is referred to as the Business as Usual (BAU) scenario.

Farmers were then asked the same set of intentions after considering a hypothetical increase in the annual Pillar 1 payment of 25% compared to their present payment rate. Again, this was assuming present economic and other policy conditions were at the same level as 2013. This is referred to as the payment increase scenario (PINC). Farmers were then asked to consider a hypothetical decrease in annual Pillar 1 payments of 25% compared to the present payment rates assuming present economic and other policy conditions were at the same level as 2013. This is the payment decrease scenario (PDEC). The parameter of 25% emerged from farm level modelling scenarios identifying the expected extent of the impact of CAP reform on farming sectors within Scotland (see Ahmadi *et al.,* 2014).

It is arguable that farmers can disassociate the full effects of the CAP from other drivers on their decision making. However, we follow a similar approach to other studies which have specified hypothetical scenarios relating to CAP removal and reform (e.g. Breen *et al*., 2005; Gorton *et al*., 2008; Latruffe *et al*., 2013; Raggi *et al*., 2013; Giannoccaro and Berbel, 2013). Also, focusing on Pillar 1 payments, which contributes to around 70 to 80% of all farm subsidy payments in Scotland, controls for the majority of these other effects.

The survey yielded 1,764 observations from livestock based holdings. These were then matched with JAS data to provide further information on activity levels, such as

size, economic size units, main activities and regional distribution. Table 1 shows descriptive statistics for the main variables matched within the JAS. Statistical comparison, conducted through t-tests, indicated no significant differences between key identifiers in the sample and the census.

Table 1. Survey respondents by NUTS2^ region classification, mean and standard deviation

2.2. Estimation strategy

As responses were categorical, a logistic regression approach was applied to the data. One intention related to exiting the business and this was handled as a straight binary variable (y | 0,1), with 1 reflecting the intention to exit. For the remainder, the intentions statements were along a 3-point scale (decrease, stay stable, increase) and multinomial logistic regression was used. This is appropriate when categorical responses exceed a binary outcome and are not ordered in any way. Hence, in equation 1 let *J* be the number of nominal outcomes and *m* the class of y outcomes, that is, (0) stay the same, (1) increase, and (2) decrease. Thus, considering the range of outcomes (*y*), the predicted probability of the i-*th* farmer choosing a nominal outcome (y = 0,1,2) is:

$$\Pr(y_i) = m|x_i' = \frac{\exp(x_i'\beta_m)}{\sum_{j=1}^{J}\exp(x_i'\beta_j)} \quad (1)$$

Where $\beta_0 = 0$

This provides indications of the probability of a change in the independent variable (x) affecting membership of one of the three classes. The base outcome class of staying the same (y=0) was used for referencing the intention to change. The

dependant variable was a stated increase in intention relative to staying the same, or a stated decrease in the intention relative to staying the same. All explanatory variables were either binary or categorical. Categorical responses were converted into dummy variables and are presented conditional on the reference value specified in Table 2 below. All intentions were estimated within this regression framework with a fixed set of independent variables. Estimation was conducted within Stata 13.1 (Stata Corp, 2013).

Table 2. Variables used within the empirical model and distributions

Past responses to CAP reform are included as a variable for explaining future intentions. The reform of the CAP would be expected to be a 'trigger' event to changing path dependency (Sutherland *et al*., 2012) and we would expect this to have a significant effect on future intentions. Furthermore, the hypothetical payment scenarios were included to estimate the strength of a payment increase or a payment decrease on a stated intention. Pillar 1 payments in Scotland are almost fully decoupled from activity levels, hence these payment rates should, in theory, have little effect on intention levels. Breen *et al*. (2005) found that a sample of Irish cattle, dairy and tillage farms did not behave rationally with respect to reductions in payment rates and, in fact, displayed inertia towards changing the business, when compared with an optimising modelling approach. Tranter *et al. (*2007) asked cropping farmers in the UK, Germany and Portugal their responses to detaching payments from current land use and also found a similar lack of response to decoupled payments and changing activity levels. Nevertheless, some studies

argue that support payments are '*partially coupled'* within farmer decision making. That is, the size of the subsidy will still influence activity rates (Moss *et al.,* 2002; Lobley and Butler, 2010). Accordingly, including these variables would give an estimate of the parameter effects of how these payment rates affect the robustness of the planned intention.

The age of the farmer is a typical variable in most studies of farmer decision making and these tend to find that younger farmers will be more innovative and seek a change in the farm business with respect to agricultural expansion and associated activities (Willock *et al*., 1999; Douarin *et al*., 2007; Morgan Davies *et al.,* 2012). Raggi *et al.* (2013) examined nine EU countries to explore farmer exit strategies and the determinants of land re-allocation. They found age to be significant and positive with respect to exiting the industry but negative with respect to selling the land. They argued this latter effect was due to older farmers having a greater emotional attachment to their land. Latruffe *et al.* (2013), using the same scenarios as Raggi *et al.* (2013), found similar effects for two regions within France. In addition, being educated at college level tends to be positively related with respect to increasing agricultural and non-agricultural activities (Willock *et al.,* 1999; Gorton *et al*., 2008; Barnes *et al*., 2009; Guillem *et al.,* 2012). We would therefore expect education levels to be positively related to all activities.

Latruffe *et al*. (2013) reviewed studies on land ownership and intentions to sell land. They found a mixed effect, as it may be a consequence of higher farm value which leads to a higher probability of sale. Conversely it may allow greater access to finance and, as a means of sustaining the business, may be less likely to be sold.

Consequently, this variable is quite context specific and it is difficult to draw general conclusions from these studies.

The level of regular labour is used to infer the physical and size capacity for change, as farm labour availability is a significant constraint to expansion of activities, especially in countries with a high remoteness profile such as Scotland (Stott *et al.,* 2005). This is because a significant percentage of land is in rough grazing and therefore of low economic value. Hence, labour employed, in the Scottish context, would be a more appropriate indicator of size than other available indicators. Thus, whilst Raggi *et al*. (2013) found increasing land area to lead to less likelihood of exiting for their study of nine EU countries, a finding which was echoed by Latruffe et al. (2013) and Giannoccaro and Berbel (2013), land area would not adequately capture physical capacity within Scotland.

Previous studies have emphasised the importance of farm family life cycles to maintain or change farming structures (Ilbery, 1978; Gasson and Errington, 1993; Errington, 1998). Lobley and Butler (2010) found identification of a successor to be a determinant of a more positive attitude towards farming in a survey of farmers within the South-West of England. These authors emphasise the importance of inheritance and succession in securing the long-term viability of the farm. Accordingly, the identification of a successor would, we expect, be positively related with expanding farm planning trajectories.

Less-Favoured Area (LFA) designation has not been explored in much detail within studies of future farming intentions. However, much like the labour variable above, it infers a biophysical constraint to the options available for farmers. Latruffe *et al*. (2013) found that LFA designation for farms in several French regions led to less

likelihood of farmers selling their land. This result reflects the limited demand and, subsequent value, for land within Less Favoured Areas. Accordingly, we would expect that farmers with the majority of their farms within LFA areas would have a more constrained set of agricultural opportunities and, hence, limit the desire for change within a business.

Finally, the dairy sector is generally seen as more progressive and intensive compared to other livestock sectors within Scotland (Barnes *et al.,* 2010; Withers, 2013). Hence, a dummy variable was used to capture these livestock effects and reflect specialised activity. This would, we expect, explain some of the intentions to increase agricultural activity.

3.0. Results

3.1. Descriptives

Figure 1 shows the distribution of responses to the payment scenarios. These are summed across each of the hypothetical payment scenarios to give an illustration of the responses to each intention. Much like other studies (Breen *et al.,* 2005; Tranter *et al.,* 2007; Gorton *et al.,* 2008; Lobley and Butler, 2010) the bulk of farmers indicated no change in activity by 2020. An average of 70% of farmers expressed this desire under the business as usual scenario, 72% under a payment increase, and 66% when payments were reduced. It seems that, under business as usual conditions, between 10% to 30% still intend to increase their activities. The most

popular activities are to increase the number of livestock and the intensity of their production.

Figure 1. Sensitivities of change to payment scenarios, percentage sum by intention if a) Pillar 1 payments remain the same, b) Pillar 1 payments increase by 25%, c) Pillar 1 payments decrease by 25%

The response to the payment scenarios are also shown in Table 3 and calculated as the percentage difference between the business as usual scenario and the payment increase or payment decrease scenarios. An additional 29% of farmers would increase the size of their business if payments were to increase. An additional 15% would increase their amount of livestock and 13% would intensify their business. Moreover, an additional 15% of farmers stated they would employ more regular labour under a payment increase.

Table 3. Sensitivities of response to payment scenarios relative to Business as Usual, percentage by intention if a) Pillar 1 payments increase by 25% or b) Pillar 1 payments decrease by 25%

A reduction in Pillar 1 payments would lead to around half of the farmers surveyed stating an intention to decrease their livestock numbers and 46% of farmers reducing the intensity of their production. This equates to an additional 35% to 38% of farmers intending to decrease their agricultural activities if payments were reduced, compared to Business as Usual conditions. An additional 6% of farmers stated a desire to exit if Pillar 1 payments were to decrease.

358 The next series of tables shows the results from the multinomial logistic regressions
359 with respect to intentions to increase or decrease activity. Under the final
360 specifications of the model, a number of variables proved to be highly significant and
361 allowed correct classification of around 70% of the sample into the three categories
362 considered (increasing, stable and decreasing activity). However, the estimates
363 generated a pseudo R^2 of between 0.11 to 0.32, indicating high levels of unobserved
364 individual heterogeneity within the sample. Nevertheless, this is common in previous
365 studies of intentions (Bougherara and Latruffe, 2010; Giannoccaro and Berbel, 2013;
366 Latruffe *et al*., 2013). The explanatory variables were all categorical and, hence, the
367 exponent of the multinomial logit coefficient was calculated to indicate the relative
368 risk ratio (RRR) of the effect of a variable on membership of increasing or decreasing
369 intentions. The Relative Risk Ratios (RRR) can be read as the effect on the
370 outcome of a unit change in the predictor variable, given other variables in the model
371 are held constant.

372 *3.2. Intentions to exit farming*

373 Table 4 shows the relative risk ratios related to the intention to exit farming by 2020.
374 Decreasing Pillar 1 payments, increasing age of the farmer and not having identified
375 a successor are significant variables.

376 A hypothetical reduction in payment would lead to an additional 6% of farmers who
377 would probably exit by 2020. Latruffe *et al.* (2013), applying the more extreme
378 scenario of CAP removal, found an additional 21% of French farmers in their study
379 region, above those who stated the desire to exit anyway, would exit farming. Raggi
380 *et al.* (2013) also found a sharp rise in farmers stating a desire to exit, relative to
381 those exiting anyway, if CAP payments were removed.

Table 4. Logistic regression model on intention to exit farming, relative risk ratios

The intention to exit increases with age and this agrees with Latruffe *et al*.'s (2013) study for French farmers. Raggi *et al.* (2013) in their wider study of 9 EU countries found similar results. The final indicator is the identification of a successor which here is negatively related to exiting the business. It therefore agrees with the majority of past studies that find succession to have a positive influence on remaining in farming (Lobley and Butler, 2010).

We find no effect of labour employed, whereas other studies do find that larger and medium sized farms are less likely to exit (Bougherara and Latruffe, 2010; Latruffe et al, 2013; Raggi et al., 2013). However, these studies did not use size of the labour force but tended to focus on area owned. This latter variable is complicated by the large areas of rough grazing generally found on Scottish cattle and sheep farms (Scottish Government, 2014). Within the Scottish context this is low value, marginally productive land, and less of a constraint than labour usage.

3.3. Intentions related to increasing or decreasing agricultural production

Table 5 shows the influence of the range of variables in determining an increase or a decrease in agricultural activity up to 2020. Common significant variables are; i) having responded similarly since past CAP reform, ii) responding positively to a change in payments, i.e. stating an intention to increase activity when payments increase or stating an intention to reduce activity if payments decrease, and iii) having identified a successor for the business.

Table 5. Multinomial logistic regression model on agricultural intentions by 2020, relative risk ratios

Both the payment scenarios and response to past reforms are highly significant toward changing intensity and size of the herd. Relative risk ratios for increasing activity, if such activity has increased since the last reforms (RINC), are around 2 to 3 times higher relative to staying the same. Conversely, relative risk ratios are around 4 times higher for the intention to decrease activity if activity has decreased since previous reform (RDEC). This provides some context for explaining the findings of previous studies, which identify a reluctance to change under CAP reform and instead opt for the *status quo* position (Breen *et al*., 2005; Tranter *et al*., 2007; Gorton *et al*., 2008; Latruffe *et al*., 2013). In addition, this also shows an underlying inference of the fixity of assets, that is any disinvestment in physical and human capital is difficult and will lead to a position of protection of erosion of that capital. Consequently, the farmers surveyed here will be reluctant to change due to these 'lock-in' effects.

The response to payment scenarios were included as a set of dummy variables relative to no change, that is the intention to increase or decrease activity if payments increase (PI-I; PI-D) and, conversely, the intention to increase or decrease activity if payments decrease (PD-I; PD-D). For both intensity of production and changing the size of herd this seems to infer that there may still be some link between Pillar 1 payments and agricultural production. Relative risk ratios are between 3 to 4 times higher than no change, indicating that changes in payment will lead to the greater intention to change the business. This echoes the retrospective study of hill sheep farms in Scotland (Morgan-Davies *et al*., 2012) who found that

431 farmers had decreased animal numbers in response, in part, to loss of subsidies
432 from the 2003 regime changes. Other studies across the EU (Bartolini and Viaggi,
433 2013; Raggi *et al*., 2013; Gianncarro and Berbal, 2013) found that reductions in CAP
434 payments, through removal of payments, tends to reduce the expansionist
435 tendencies within farmers. This is true here of livestock farmers within Scotland if
436 payments were to reduce.

437 **Table 6. Multinomial logistic regression model on land and labour intentions**
438 **by 2020, relative risk ratios**
439

440 Regular employment and land rental based intentions show past policy response is a
441 significant predictor of future intention. If farmers had responded to the 2003 reforms
442 by undertaking these changes on the farm, they are more likely to increase or
443 decrease this activity under the latest reforms of the CAP, rather than maintain
444 present structures. The relative risk ratios are high and significant when intentions
445 follow the same trajectory, for example increasing activity in the past leads to
446 intentions to increase activity under new reforms. However, for some intentions the
447 converse is also significant, that is if land rental or land contracting activity increased
448 in the past then this could lead to the intention to decrease activity. These RRR's
449 are lower and less significant but are reflective of the short-term nature of renting
450 and contracting land in Scotland. This is determined by seasonal changes in
451 stocking levels and evidenced by informal arrangements surrounding them
452 (Thomson *et al.,* 2014). Moreover, Ward *et al* (1990) found mixed results of land
453 ownership arrangements and localised effects on landscape change within five case
454 studies across the UK. They suggested that landscape change, reflective of an
455 intensifying landscape, occurred on land which changed tenure. The effect on

456 regular labour may be evidence of the competing factors that determine farm
457 household and business structure, in particular, the uncertainty of fluctuating
458 demand for on-farm labour against household and off-farm labour requirements
459 (Loughrey *et al*., 2013).

460 The two payment scenarios also have mixed responses with respect to labour and
461 land. A hypothetical increase in Pillar 1 payments leads to the intention to increase
462 the level of employed labour, the level of family labour and to rent in more land.
463 Conversely, a payment increase could also lead to the intention to decrease family
464 labour. This latter result may be the effect of higher income support payments
465 triggering farmers to release family labour from on-farm work to other activities.
466 Goetz and Debertin (1996) and Petrick and Zier (2011) also found this effect related
467 to increases in CAP payments.

468 If payments were reduced this may also trigger an increase or a decrease in the
469 amount of family labour employed on the farm. Increasing family labour would
470 provide support for lost income or to cover the intended loss of employed labour, if
471 supporting payments for this activity were to reduce. Nevertheless, this effect is
472 perhaps reflective of diverse family household structures and the response to
473 decoupled payments in terms of withdrawing from farming operations.

474 Other factors which influence increasing the level of employed labour are age and
475 identification of a successor, reflecting both the more innovative approaches of
476 younger farmers and the positive outlook of those farmers who have assurance that
477 their farm will continue after retirement (Lobley and Potter, 2004). Decreasing the
478 level of employed labour is driven by increasing age, which may relate to a running

down of farming production in older farmers without successors (Potter and Lobley, 1992).

With respect to land rented in or out, changing Pillar 1 payments has an effect. If payments increased then farmers would have a higher propensity to rent in more land and this could be reflective of increasing optimism within farming that these higher levels of subsidies may realise. Alternatively, more land could be rented out. This latter decision may be reflective of withdrawal for maintaining the stricter requirements proposed under greening and cross-compliance. Bougherara and Latruffe (2010) examined intentions for land use with a sample of 80 French farmers under the 2003 CAP reforms. They found that the probability of idling land, as well as maintaining cross-compliance conditions, were less likely to occur if the costs of conversion were seen to be high. This may be occurring here as payment increases provides an incentive to reduce the perceived burden of management of land or the opportunity to rent out more land. Decreasing payment rates does not seem to have an effect on land rental activity.

4.0. Conclusions

The general finding from previous studies of farmer intentions is the lack of desire to change farm planning trajectories. This is because farmers are locked into an asset structure which leads to high exit costs (Latruffe *et al.,* 2013). This asset fixity occurs where capital and labour remain within farming, even though their returns are low, due to lack of mobility and opportunity (Ackrill, 2000). In addition, some evidence exists for the non-pecuniary benefits of agriculture which explains the desire to remain in farming from the satisfaction it brings, even when incomes are low

(Roberts and Key, 2009; Howley *et al*., 2015). Thus, these offer some foundation for understanding the reluctance to exit the industry revealed by this and other studies.

Aligning the path dependency model to farming intention studies offers a further conceptual basis for understanding future planning behaviours to explain the desire to increase or decrease activity. Previous studies have tended to ignore these effects, or only alluded to the nature of their influence. Skokstad (2010) and Viaggi *et al*. (2013) both included some dynamic effect in their studies of willingness to sell land after the decision to exit farming has been made. It is clear from our study that past behaviour does explain a number of other stated agricultural intentions as well.

Hence, it would seem that making past behaviours more explicit in studies of farmer intentions would be an important extension to this type of research. In most cases, these have a stronger influence on intended behaviour than the standard socio-economic and structural factors, which have been examined in previous studies (e.g. Lobley and Butler, 2010; Tranter et al., 2007). In addition, this study suggests that past behaviour can have an influence which is equal to or exceeds a change in subsidy payment on predicting future intentions.

Nevertheless, the intention to change is also driven, to some extent, by these common farm structure and socio-economic variables. The most significant indicator seems to be the identification of a successor. Very few studies within the intentions literature account for succession directly, for instance Raggi *et al.* (2013) included the influence of farming household members and this could be taken as a proxy for succession. The influence of identifying a successor is positive and mostly significant across the options tested. Sutherland *et al.* (2012), in their conceptualisation of this transition process, argue that succession can be a key

528 'trigger point' for change to farming trajectories, but can also lead to a longer term
529 continuation of an existing farm trajectory (depending on the extent to which the
530 successor was embedded in the business prior to succession occurring). Whilst
531 succession has been found to be strongly significant, other socio-economic
532 variables, such as education and holding status performed less well in predicting
533 increasing activity.

534 The age of the farmer tends be another significant variable. Younger farmers wish to
535 increase production activity. This is consistent with an analysis of Eurostat figures
536 undertaken by Zagata and Sutherland (2015), which found that young sole holders
537 on average operate more economically efficient and productive farms. What has not
538 been estimated is the influence of new entrants, as opposed to younger farmers, on
539 intentions. Gorton *et al.* (2008), within their segmentation of farmers in five EU
540 member states, found a 'new entrants' cluster, which was heavily populated by
541 farmers within what were (at the time), new member states, of Lithuania and
542 Slovakia. This group expressed the strongest desire to expand the business,
543 relative to other more traditional farming clusters found within their study. Hence, it
544 could be hypothesised that new entrants would have the same positive effect on
545 increasing production as younger farmers. In relation to this, the influence of
546 inheritance of the farm tends to be nominal and, in most cases insignificant.
547 Accordingly, new entrants and their intentions towards production may be a
548 profitable area for further investigation.

549 Payment changes in Pillar 1 may be seen as a trigger event to change this path
550 dependency. This study finds there is some effect with respect to Pillar 1 payments,
551 which seems to infer that payments are not as decoupled as policy makers would

552 wish. Furthermore, for some of the intentions, such as intensity of production, the
553 number of livestock and the level of employed labour, these are more sensitive to a
554 reduction than an increase. This perhaps offers a perspective on the loss aversion
555 effect, that is, farmer behaviour is moderated through a risk perception framework
556 whereby they are more sensitive to a loss compared to an equivalent gain.
557 Bocqueho *et al.* (2014), in their study of bonuses and penalties, found a similar loss-
558 aversion effect for farmers in Eastern France.

559 Examining farmer intentions is recognised as a contentious area, as these stated
560 intentions under hypothetical scenarios may not ultimately lead to the identified
561 behavioural outcomes (Viaggi *et al*., 2011; Latruffe *et al*., 2013) and this aligns with
562 other studies which make a distinction between attitudes and behaviours (Liska,
563 1974; Gasson, 1974; Ilbery, 1978; Kraus, 1995). Gorton *et al.* (2008) contend that
564 when intentions reflect a short time frame then there is more basis for robust
565 evaluation of intentions. Studies with longer planning horizons may be expected to
566 have an increased variance between stated intentions and actual behaviour. The
567 reform of the CAP will add another layer to decision-making uncertainties or may
568 reflect Weber's (1997) contention that we operate within a 'finite pool of worry' and
569 the full implications of CAP reform are too distant to consider for farmer decision-
570 making. In addition, like all surveys of future intent, the responses may have some
571 built-in bias which would be reflective of present agricultural conditions and outlook.
572 In Scotland, at the time of the survey, farmers were recovering from severe wet
573 weather incidents which led to the loss of stock in more remote farming areas.
574 Consequently, we would have expected less optimism in the responses; that is,
575 more farmers declaring to reduce activity or exit. That we found a high level of
576 tenacity to remain within farming may provide evidence of the robustness of the

577 survey instrument in polling farmer opinions towards the future of their industry. This
578 relatively positive view of the future in spite of recent challenges is also consistent
579 with Lobley and Potter's (2004) finding, where the majority of farmers in their English
580 study had similarly expressed strong commitments to continue to remain engaged as
581 primary occupation farmers (i.e. the majority of their household incomes from
582 farming) despite recent hardships.

583 Finally, a policy goal within the UK and other countries has been the focus towards
584 increasing the efficiency and production of food, in particular through promoting the
585 sustainable intensification of farming (Royal Society, 2009; Marsden, 2010;
586 Foresight, 2011). Rickard (2015) has argued that the CAP will slow down the
587 structural change needed within the industry to meet this goal due to its focus on
588 protecting small-scale farming viability. We find that changes in payment rates will
589 influence the intention to intensify and perhaps reflects a view that the payment
590 offers leverage to invest in structural change.

591 Overall this study, and previous studies towards farming intentions under CAP
592 reform, places the farmer within a wider trajectory than changing CAP payments on
593 influencing change and argues for a more dynamic approach to understanding the
594 factors behind future intentions. This has consequences for the ambitions of future
595 CAP reforms and, moreover, the negotiations towards tailoring the operational
596 requirements at a national, as oppose to an EU, level.

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References

Ackrill, R. 2000 The Common Agricultural Policy. Sheffield Academic Press, Sheffield, 248 pp.

Ahearn M.C., Yee J., Korb P. 2005. Effects of differing farm policies on farm structure and dynamics. *American Journal of Agricultural Economics.* 87,1182-1189.

Ahmadi, B., Shrestha, S.S., Thomson, S.G., Barnes, A.P., Stott, A.S. 2014. Impact of greening the Common Agricultural Policy on Scottish beef and sheep farms. *Journal of Agricultural Science* 153, 676 – 688.

Backus, G.B.C., Eidman, V.R., Dijhuizen, A.A. 1997. Farmer decision-making under risk and uncertainty. *Netherlands Journal of Agricultural Science* 45, 307-328.

Barnes, A.P., Reveredo-Giha, C., Sauer, J., Elliot, J., Jones, G. 2010 A report on technical efficiency at the farm level 1989 to 2008. Final Report to Defra, London.

Barnes, A.P., Willock, J., Toma, L. and Hall, C (2011). Utilising a farmer typology to understand farmer behaviour towards water quality management: Nitrate Vulnerable Zones in Scotland. *Journal of Environmental Planning and Management,* 54 (4) 477-482.

Barnes, A.P., Toma, L. 2012. A typology of dairy farmer perceptions towards climate change. Climatic Change. 1122, 507-522.

624 Barnes, A.P., Willock, J. Hall, C., Toma, L. 2009. Farmer perspectives and practices
625 regarding water pollution control programmes in Scotland. *Agricultural Water*
626 *Management.* 96, 1715-1722.

627 Bartolini, F., Viaggi, D. 2013. The common agricultural policy and the determinants
628 of changes in EU farm size*. Land Use Policy.* 31, 126-135.

629 Beal, D.J. 1996. Emerging Issues in Risk Management in Farm Firms. *Review of*
630 *Marketing and Agricultural Economics.* 643, 336-347.

631 Binswanger, H., Sillers, D.A. 1983. Risk aversion and credit constraints in farmers'
632 decision-making: A reinterpretation. *The Journal of Development Studies*. 20, 5-
633 21.

634 Brady M., Kellermann K., Sahrbacher C., Jelinek L. 2009. Impacts of Decoupled
635 Agricultural Support on Farm Structure, Biodiversity and Landscape Mosaic:
636 Some EU Results. *Journal of Agricultural Economics.* 60,563-585.

637 Breen, J.P., Hennessy, T.C., Thorne, F.S. 2005. The effect of decoupling on the
638 decision to produce: An Irish case study. *Food Policy.* 30, 129-144

639 Brian, A.W. (1994), *Increasing Returns and Path Dependence in the Economy*, Ann
640 Arbor, Michigan: University of Michigan Press, 224 pp..

641 Bocqueho, G., Jacquet, F., Reynaud, A. 2014. Expected utility or prespect theory
642 maximisers? Assesing farmers' risk behaviour from field-experiment data.
643 *European Review of Agricultural Economics.* 41, 135-172.,

644 Bohnet, I., 2008. Assessing retrospective and prospective landscape change through
645 the development of social profiles of landholders: a tool for improving land use
646 planning and policy formulation. Landsc. Urban Plan. 88, 1–11.

647 Bougherara, D., Latruffe, L. 2010. Potential impact of the EU 2003 CAP reform on
648 land idling decisions of French landowners: Results from a survey of intentions.
649 *Land Use Policy.* 27, 1153-1159.

650 Bowler, I.R. 1992. ‘Sustainable agriculture' as an alternative path of farm business
651 development. In Rural Systems in Transition, Bowler, I.R., Bryant, C.R. and
652 Nellis, M.D. (eds). CAB International, Wallingford.

653 Brunori, G., Malandrin, V., Rossi, A., 2012. Trade-off or convergence? The role of
654 food security in the evolution of food discourse in Italy. Journal of Rural Studies
655 29, 19-29.

656 Burrell, A. 2009. The CAP Looking Back, Looking Ahead. *Journal of European*
657 *Integration.* 31, 271-289.

658 Burton, R., 2004. Seeing through the ‘good farmer’s’ eyes: Towards developing an
659 understanding of the social symbolic value of ‘productivist’ behaviour. Sociologia
660 Ruralis 44, 195-215.

661 Burton, R., Kuczera, C. and Schwarz, G., 2008. Exploring farmers' cultural
662 resistance to voluntary agri-environmental schemes. Sociologia Ruralis 48, 16-
663 37.

664 Burton, R.J.F., Walford, N. 2005. Multiple succession and land division on family
665 farms in the South East of England: A counterbalance to agricultural
666 concentration? *Journal of Rural Studies.* 21, 335-347.

667 Commission of the European Communities. 1991. The development and future of
668 the CAP. Communication of the Commission to the Council. Reflections paper
669 of the Commission. Available at: http://ec.europa.eu/agriculture/cap-
670 history/1992-reform/com91-100_en.pdf

671 David, P. 1985. Clio and the Economics of QWERTY. *American Economic Review*
672 75, 332-337.

673 Davies, B.B., Hodge, I.D., 2007. Exploring environmental perspectives in arable
674 agriculture:a Q methodology study in East Anglia, UK. Ecol. Econ. 61, 323–333.

675 Defrancesco, E., Gatto, P., Ford, R., Samuele, T. 2008. Factors Affecting Farmers’
676 Participation in Agri-environmental Measures: A Northern Italian Perspective.
677 *Journal of Agricultural Economics.* 59, 114-131.

678 Dibden, J., Cocklin, C. 2005. Sustainability and agri-environmental governance. In:
679 Higgins, V., Lawrence, G. (Eds.), Agricultural Governance: Globalisation and the
680 New Politics of Regulation. Routledge, London, 135-152.

681 Douarin, E., Latruffe, L., Bailey, A., Davidova, S., Gorton, M. 2007. Structural,
682 Location and Human Capital Determinants of Farmers' Response to Decoupled
683 Payments. IDEMA Working Paper.

684 European Commission 2013. Overview of CAP Reform 2014-2020. Agricultural
685 Policy Perspectives Brief N°5/ December 2013. Avalible at:
686 http://ec.europa.eu/agriculture/policy-perspectives/policy-briefs/05_en.pdf

687 European Commission 2014. Share of direct payments and total subsidies in
688 agricultural factor income 2010- 2012 average. CAP post-2013: Key graphs &
689 figures, European Union, Brussels. 2014.

690 Errington, A.J. 1998. The intergenerational transfer of managerial control in the farm-
691 family business: A comparative study in England, France and Canada. *Journal of*
692 *Agricultural Education and Extension.* 5, 123–36

693 Evans, N. (2009). Adjustment strategies revisited: agricultural change in the Welsh
694 Marches. Journal of Rural Studies, 25(2), 217-230.

695 Foresight 2011. The Future of Food and Farming. The Government Office for
696 Science, London.

697 Gallerani V., Gomez y Paloma S., Raggi M., Viaggi D. 2008. Investment behaviour in
698 conventional and emerging farming systems under different policy scenarios,
699 JRC Scientific and technical reports, EUR 23245 EN – 2008.

700 Garforth, C., Rehman, T., 2006. Research to Understand the Model the Behaviour
701 and Motivations of Farmers in Responding to Policy Changes (England). Final
702 Report. Research Project EPES 0405/17. Department for Environment, Food
703 and Rural Affairs (DEFRA), School of Agriculture, Policy and Development,
704 University of Reading

705 Gasson, R. 1974. Socioeconomic status and orientation to work: the case of farmers.
706 Sociologia Ruralis 14(3), p. 127–141

707 Gasson, R. , Errington, A. 1993. The Farm Family Business. Wallingford, Oxford,
708 UK, 304 pp.

709 Giannoccaro G., Berbel, J. 2013. Farmers' stated preference analysis towards
710 resources use under alternative policy scenarios. *Land Use Policy*. 31, 145–155

711 Goetz, S.J., Debertin, D.L. 1996.Rural Population Decline in the 1980s: Impacts of
712 Farm Structure and Federal Farm Programs. *American Journal of Agricultural*
713 *Economics*. 78, 517-529.

714 Gorton, M. Douarin, E., Davidova,S., Latruffe,L. 2008. Attitudes to agricultural policy
715 and farming futures in the context of the 2003 CAP reform: A comparison of
716 farmers in selected established and new Member States, *Journal of Rural*
717 *Studies.* 243, 322-336

718 Gray, J., 1998. Family farms in the Scottish borders: a practical definition by hill
719 farmers. Journal of Rural Studies 14, 241-356.

720 Guillem, E.E., Barnes, A.P. 2012. Farmers perceptions of bird conservation and
721 farming management at a catchment level. *Land Use Policy*. 31, 565-575

722 Guillem, E.E., Barnes, A.P., Rounsevell, M. and Renwick, A. 2012. Refining
723 perception-based farmer typologies with the analysis of past land use change.
724 *Journal of Environmental Management*. 110 15, 226-235.

725 Hardaker, J.B., R.B.M. Huirne, J.R. Anderson, Lien, G. 1997. *Coping with Risk in*
726 *Agriculture*, CAB International, Wallingford, 352 pp.

727 Harrington D.H. 2005. Agricultural Structural Adjustments to U.S. Policies:
728 Discussion Paper. *American Journal of Agricultural Economic*s. 87, 1198-1199.

729 House of Commons Environment, Food and Rural Affairs Committee HCEFRAC
730 2012 Greening the Common Agricultural Policy. First Report of Session 2012–
731 13. HMSO, London.

Howley, P., Buckley, C., O'Donoghue, C.O., Ryan, M. 2015 Explaining the economic 'irrationality' of farmers' land use behaviour: the role of productivist attitudes and non-pecuniary benefits. *Ecological Economics*. 109, 186-193.

Ilbery, B.W. 1978. Agricultural Decision-Making: A behavioural perspective. *Progress in Human Geography.* 2, 448-466.

Islam, M., Barnes, A.P., Toma, L. 2013. Climate Change scepticism among farmers. *Journal of Environmental Psychology. 34, 137-150.*

Kay, A. 2003. Path dependency and the CAP. *Journal of European Public Policy.* 10, 405-420

Kraus, S.J. 1995. Attitudes and the Prediction of Behavior: A Meta-Analysis of the Empirical Literature. Pers. Soc. Psychol. Bull. 21(1), p. 58-75

Latruffe, L., Dupuy, A., Desjeux, Y. 2013. What would farmers' strategies be in a no-CAP situation? An illustration from two regions in France. *Journal of Rural Studies.* 32, 10-25.

Liska, A.E. 1974. Emergent issues in the attitude-behavior consistency controversy. American Sociological Review 39(2) p. 261-272

Lobley, M., Potter, C. 2004. Agricultural change and restructuring: recent evidence from a survey of agricultural households in England. *Journal of Rural Studies.* 20, 499-510

Lobley, M., Butler, A. 2010. The impact of CAP reform on farmers' plans for the future: Some evidence from South West England. *Food Policy.* 35, 341-348.

Lobley, M., Baker, J.R., Whitehead, I. 2010. Farm succession and retirement: Some international comparisons. *Journal of Agriculture, Food Systems, and Community Development. 1, 49.*

Loughrey, J., Hennessy,T., Hanrahan, K., Donnellan,T., Raimondi, V. , Olper, A. (2013). Determinants of Farm Labour Use: A Comparison between Ireland and Italy. *Selected Paper prepared for presentation at the International Agricultural*

759 *Trade Research Consortium's (IATRC's) 2013 Symposium: Productivity and Its*
760 *Impacts on Global Trade, June 2-4, 2013, Seville, Spain.*

761 Marsden, T. 2010. Food 2030, towards a redefinition of food? A commentary on the
762 New United Kingdom Government food strategy. *The Political Quarterly.* 81,
763 443-446.

764 Meert, H., Van Huylenbroeck,G., Vernimmen,T., Bourgeois,M., van Hecke, E. 2005.
765 Farm household survival strategies and diversification on marginal farms.
766 *Journal of Rural Studies* 21, 81-97.

767 Mishra A.K., Raggi M., Viaggi D. 2010. Determinants of farm exit: a comparison
768 between Europe and the United States. *114th European Association of*
769 *Agricultural Economists EAAE Seminar*. Berlin, Germany.

770 Morgan-Davies, C., Waterhouse, T., Wilson R. 2012. Characteristion of farmers'
771 responses to policy reforms in Scottish hill farming areas. *Small Ruminant*
772 *Research.* 102, 96-107.

773 Moss, J., McErlean, S., Kostov, P., Patton, M., Westhoff, P., Binfield, J. 2002.
774 Analysis of the Impact of Decoupling on Agriculture in the UK. Queens
775 University, Belfast.

776 O'Donnell, S., Horan,. B., Butler, A.M., Shalloo, L. 2011. A survey of the factors
777 affecting the future intentions of Irish dairy farmers*. Journal of Agricultural*
778 *Science.* 149, 647–654

779 Petrick, M., Zier, P. 2011. Regional Employment Impacts of Common Agricultural
780 Policy Measures in Eastern Germany: A Difference-in-Differences Approach.
781 *Agricultural Economics.* 42, 183-93.

782 Potter, C., Lobley, M. 1996. The farm family life-cycle, succession paths and
783 environmental change in Britian;s countryside. *Journal of Agricultural*
784 *Economics.* 47, 172-190.

785 Raggi, M., Sardonini, L., Viaggi, D. 2013. The effects of the Common Agricultural
786 Policy on exit strategies and land re-allocation. *Land Use Policy.* 31, 114-125.

787 Ribeiro, P.F., Lima Santos, J., Bugalho, M.N., Santana, J., Reino, L., Beja, P.,
788 Moreira, F. 2014. Modelling farming system dynamics in High Nature Value
789 Farmland under policy change, *Agriculture, Ecosystems & Environment.* 183,
790 138-144.

791 Rickard, S., 2004. CAP reform, competitiveness and sustainability. *Journal of the*
792 *Science of Food and Agriculture*. 84, 745-756.

793 Rickard, S. 2015. Food Security and Climate Change: The Role of Sustainable
794 Intensification, the Importance of Scale and the CAP. Eurochoices. 14, 48–53.

795 Roberts, M.J., Key, N. 2009 Nonpecuniary benefits to farming: Implications for
796 supply response to decoupled payments. *American Journal of Agricultural*
797 *Economics*. 91, 1-18.

798 Royal Society 2009. Reaping the benefits, Science and the sustainable intensification of
799 global agriculture. RS Policy document 11/09. Royal Society, London, October
800 2009.

801 SAC 2008. Response from the Hills. SAC, Edinburgh.

802 Schmid, E., Sinabell, F. 2003. On the choice of farm management practices after
803 the reform of the Common Agricultural Policy in 2003. *Journal of Environmental*
804 *Management.* 82, 332-340.

805 Schmid, E., Sinabell, F., Hofreither, M.F. 2007. Phasing out of environmentally
806 harmful subsidies: Consequences of the 2003 CAP reform. *Ecological*
807 *Economics.* 60, 596-604.

808 Scottish Government 2012. Final Results of the June Agricultural Census. Scottish
809 Government Directorate for Environment and Forestry. RESAS, Edinburgh, UK.

Scottish Government 2013 CAP Budget negotiations – the facts. Accessible at: http://www.scotland.gov.uk/Topics/farmingrural/Agriculture/CAP/CAPEurope10112012. Accessible on the 13th March 2014.

Scottish Government 2014 Economic Report on Scottish Agriculture 2014. Scottish Government Directorate for Environment and Forestry. RESAS, Edinburgh, UK.

Stokstad, G., 2010. Exit from farming and land abandonment in Northern Norway. In: Paper prepared for the 116th EAAE seminar Spatial Dynamics in Agri-food Systems: Implications for Sustainability and Consumer Welfare, Parma, Italy,October 27–30.

Skogstad, G., Verdun, A. 2009 The Common Agricultural Policy: Continuity and Change. *Journal of European Integration.* 313, 265-269.

Smit, B., Skinner, M.W., 2002. Adaptation options in agriculture to climate change: a typology. *Mitigation and Adaptation Strategies for Global Change*. 71, 85-114.

Sorrentino, A, Henke, R., Severini, S. 2011. The Common Agricultural Policy after the Fischler Reform. Ashgate Publishing, Surrey, 544 pp.

StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP.

Stokes, J.R., 2006. Entry, exit, and structural change in Pennsylvania's Dairy sector. *Agricultural and Resource Economics Review*. 35, 357–373.

Stott, A.W., Milne, C.E., Goddard, P., Waterhouse, A. 2005. Effect of alternative management strategies on profit and animal welfare in extensive sheep production system in Great Britain. *Livestock Production Science.* 97, 161-171.

Swinnen, J. 2010. The political economy of the most radical reform of the Common Agricultural Policy. German Journal of Agricultural Economics 59 (Supplement), 37-48.

835 Sutherland, L-A., Burton, R.J.F, Ingram, J, Blackstock, K.L., Slee, B, Gotts, N. 2012
836 Triggering change: towards a conceptualisation of major change processes in
837 farm decision-making. *Journal of Environmental Management.* 104, 142-151.

838 Thomson, S.G., Moxey, A. , Butler, A.. 2014. Scottish agricultural tenure evidence
839 review. Report for the Scottish Government. APS Group, Edinburgh.

840 Tranter, R.B., Swinbank, A.,Wooldridge, M.J., Costa, L., Knapp, T., Little, G.P.J.,
841 Sottomayor, M.L. 2007. Implications for food production, land use and rural
842 development of the European Union's Single Farm Payment: Indications from a
843 survey of farmers' intentions in Germany, Portugal and the UK. *Food Policy.* 32,
844 656-671.

845 Viaggi D., Raggi M., Gomez y Paloma S. 2011. Farm-household investment
846 behaviour and the CAP decoupling: Methodological issues in assessing policy
847 impacts. *Journal of Policy Modeling.* 33, 127-145.

848 Ward, N., Marsden, T. and Munton, R. 1990. Farm landscape change. Land Use
849 Policy 7, 291-302

850 Whatmore, S., Munton, R., Little, J., Marsden, T. 1987. Towards a typology of farm
851 businesses in contemporary British agriculture. Sociologia Ruralis 37, 21-37.
852
853 Weber, E. U. 1997. Perception and expectation of climate change: Precondition for
854 economic and technological adaptation. In M. Bazerman, D. Messick, A.
855 Tenbrunsel, & K. Wade-Benzoni Eds., Psychological Perspectives to
856 Environmental and Ethical Issues in Management, 314-341. San Francisco, CA:
857 Jossey-Bass, 314-341 pp.
858 Withers, J. 2013. Scottish Dairy Review: "Ambition 2025". Report &
859 Recommendations. Report to the Scottish Government. Available at:
860 http://www.scotland.gov.uk/Resource/0043/00434082.pdf. Accessed on 13th
861 March 2014.

862 Willock, J., Deary, I., McGregor, M., Sutherland, A., Edwards-Jones, G., Morgan, O.,
863 Dent, B., Grieve, R., Gibson, G. ,Austin, E. 1999. Farmers' attitudes, Objectives,

Behaviours, and Personality Traits: The Edinburgh Study of Decision Making on Farms. *Journal of Vocational Behaviour.* 54, 5-36.

Wilson, G.A. 2007. *Multifunctional agriculture: a transition theory perspective*. New York Oxford University Press and Wallingford CAB International, 384 pp.

Wilson, G. A. 2008. From 'weak' to 'strong' multifunctionality: Conceptualising farm-level multifunctional transitional pathways. *Journal of Rural Studies.* 243, 367-383.

Wilson, G.A., Hart, K. 2000. Farmer participation in agri-environmental schemes: towards conservation-oriented thinking? *Sociologia Ruralis.* 412, 254-274.

Zagata, L., Sutherland, L-A. 2015. Deconstructing the 'young farmer problem in Europe': Towards a research agenda. Journal of Rural Studies 38, 39-51.

Table(s)

Table 1. Survey respondents by NUTS2^ region classification, mean and standard deviation

Scottish Region	n	Standard Gross Margin~ (euro)	European Size Unit*	Livestock (No)	Area (Ha)
Eastern	295	58,976.74	41.7	141.1	393.6
SD		*77,489.47*	*54.8*	*177.4*	*641.9*
Highlands & Islands	712	22,616.50	16.0	69.8	426.1
SD		*34,125.30*	*24.1*	*116.0*	*1,937.8*
North Eastern	145	42,098.51	29.8	124.1	128.2
SD		*65,497.28*	*46.3*	*205.3*	*342.0*
South Western	600	75,248.29	53.3	211.8	200.5
SD		*97,113.73*	*68.7*	*338.9*	*355.2*

^ NUTS2 is the nomenclature of EU regions

~ Standard Gross Margin (SGM) reflects size of the enterprise and is calculated per head of livestock, using standardised SGM coefficients.

** Measured as standard gross margin divided by 1200 Euros*

Table 2. Variables used within the empirical model and distributions

Name	Description	Coding	Distributions	
R-	*Response to past CAP reform (2005)*	*Dummy variables (increase (INC) and decrease (DEC)) where the reference is no change*	*Varies per activity*	
PI-	*Response to payment increase by 25%*	*Dummy variables (increase (I) and decrease (D)) where the reference is no change*	*Varies per activity*	
PD-	*Response to payment decrease by 25%*	*Dummy variables (increase (I) and decrease (D)) where the reference is no change*	*Varies per activity*	
AGE	*Farmer age*	*Dummy variables where the reference is age being less than 44*	*Less than 44* *45-64* *65+*	*16%* *58%* *27%*
EDU	*Education*	*Dummy variable where the reference is school only education*	*School only* *College*	*49%* *51%*
OWN	*Land ownership*	*Dummy variables where the reference is owner-occupied*	*Owner-occupied* *Tenanted* *Mixed*	*63%* *25%* *17%*
LAB	*Labour employed*	*Dummy variables where the reference is no-one employed*	*None* *1-3 persons* *3+ persons*	*52%* *41%* *7%*
REG	*Region*	*Dummy variables where the reference is North East region*	*North East* *South East* *South West* *North West*	*11%* *14%* *43%* *33%*
AES	*Member of an agri-environmental Scheme*	*Dummy variable where the reference is no membership*	*No* *Yes*	*59%* *41%*
INH	*Whether the business was inherited*	*Dummy variable where the reference is not inherited*	*Not inherited* *Inherited*	*36%* *64%*
SUC	*Whether a successor has been identified*	*Dummy variable where the reference is no successor identified*	*Not identified* *Identified*	*51%;* *49%*
LFA	*Farm in a less favoured area (LFA)*	*Dummy variable where the reference is no land in LFA*	*No LFA* *LFA*	*28%* *72%*
DAIRY	*Farm is a specialised dairy farm*	*Dummy variable where the reference is not a specialised dairy farm*	*Not specialised* *Specialised*	*90%* *10%*

Table 3. Sensitivities of response to payment scenarios relative to Business as Usual, percentage by intention if a) Pillar 1 payments increase by 25% or b) Pillar 1 payments decrease by 25%

	a) PINC -BAU			b) PDEC - BAU		
	Stay Same	*Increase*	*Decrease*	*Stay Same*	*Increase*	*Decrease*
The intensity of production	-6.0	13.0	-7.0	-16.8	-18.8	35.5
The number of livestock	-6.7	14.7	-8.9	-14.5	-24.7	38.3
The size of the business	-24.0	28.9	-4.9	-14.2	1.6	12.6
The level of employed labour	-3.1	14.6	-3.7	-10.1	-11.3	29.2
The amount of family labour	4.8	-0.9	-2.8	-3.8	-10.5	15.5
The amount of land rented or contracted	6.5	6.4	-2.0	-3.7	-3.4	18.0
Sell the Business			-4.0			5.6

BAU: Business as usual conditions, where present economic conditions and pillar 1 annual payments remain at 2013 levels
PINC: Business as usual conditions, where present economic conditions stay the same, but pillar 1 annual payments increase by 25% on 2013 levels
PDEC: Business as usual conditions, where present economic conditions stay the same, but pillar 1 annual payments decrease by 25% on 2013 levels

Table 4. Logistic regression model on intention to exit farming, relative risk ratios

	Intention to exit farming	
PAYMENT DECREASE (REFERENCE CLASS : NO CHANGE)	4.26***	*(1.28)*
AGE (REFERENCE CLASS : <44)		
45-64	5.87*	*(4.32)*
65+	15.35***	*(11.53)*
EDUCATION	0.96	*(0.26)*
MANAGEMENT STATUS (REFERENCE CLASS : OWNER)		
Tenanted	0.58	*(0.20)*
Mixed	0.99	*(0.37)*
LABOUR EMPLOYED (REFERENCE CLASS : NONE)		
1-3 persons	0.95	*(0.27)*
> 3 persons	1.09	*(0.65)*
REGION (REFERENCE CLASS : NORTH EAST)		
North West	1.24	*(0.62)*
South East	2.28	*(1.21)*
South West	1.88	*(0.89)*
AES MEMBER	0.65	*(0.18)*
INHERITED	0.89	*(0.24)*
SUCCESOR	0.17***	*(0.05)*
LFA	1.22	*(0.46)*
DAIRY	1.31	*(0.72)*

Percent concordant	*96%*
-2 log likelihood	*-252.3*
Likelihood ratio (LR)	*96.50****
McFadden's R^2:	*0.161*
Nagelkerke's R^2	*0.184*
Cox and Snell R^2	*0.053*
Standard errors in parentheses	** p<.05; ** p<.01; *** p<.001*

Table 5. Multinomial logistic regression model on agricultural intentions by 2020, relative risk ratios

	The size of the agricultural enterprise				*The intensity of production*				*The number of livestock*			
	Increase[*]		*Decrease*[^]		*Increase*[*]		*Decrease*[^]		*Increase*[*]		*Decrease*[^]	
PAST RESPONSE (REFERENCE CLASS : NO CHANGE)												
RDec	0.9	*(0.3)*	0.3***	*(0.1)*	1.3	*(0.3)*	3.9***	*(0.9)*	1.4	*(0.3)*	3.6***	*(0.8)*
Rinc	2.8***	*(0.8)*	0.6	*(0.2)*	3.4***	*(0.6)*	1.3	*(0.3)*	3.2***	*(0.5)*	1.6	*(0.4)*
PAYMENT INCREASE (REFERENCE CLASS : NO CHANGE)												
PI-D	1.7	*(1.8)*	0.5	*(0.4)*	0.8	*(0.5)*	4.8***	*(1.8)*	0.6	*(0.4)*	3.1**	*(1.2)*
PI-I	4.6	*(4.9)*	0.3	*(0.3)*	3.7***	*(0.6)*	1.0	*(0.2)*	4.3***	*(0.7)*	1.1	*(0.2)*
PAYMENT DECREASE (REFERENCE CLASS : NO CHANGE)												
PD-D	1.1	*(0.2)*	0.8	*(0.2)*	0.7*	*(0.1)*	2.2***	*(0.4)*	0.7**	*(0.1)*	1.9**	*(0.4)*
PD-I	0.6*	*(0.1)*	1.0	*(0.4)*	1.6	*(0.5)*	1.4	*(0.6)*	1.4	*(0.5)*	1.1	*(0.6)*
AGE (REFERENCE CLASS : <44)												
45-64	0.5***	*(0.1)*	1.8	*(0.7)*	0.7	*(0.1)*	1.9	*(0.7)*	0.4***	*(0.1)*	1.8	*(0.7)*
65+	0.3***	*(0.1)*	1.4	*(0.7)*	0.5*	*(0.1)*	3.0**	*(1.2)*	0.2***	*(0.1)*	2.3*	*(0.9)*
EDUC	1.2	*(0.1)*	0.9	*(0.2)*	1.5**	*(0.2)*	1.3	*(0.2)*	1.8***	*(0.3)*	1.4	*(0.3)*
MANAGEMENT STATUS (REFERENCE CLASS : OWNER)												
Ten	0.7	*(0.1)*	0.9	*(0.2)*	0.7	*(0.1)*	0.9	*(0.2)*	0.8	*(0.1)*	0.9	*(0.2)*
Mix	0.9	*(0.2)*	1.8*	*(0.5)*	1.2	*(0.3)*	1.5	*(0.4)*	1.1	*(0.2)*	1.6	*(0.4)*
LABOUR EMPLOYED (REFERENCE CLASS : NONE)												
1-3	1.3	*(0.2)*	0.8	*(0.2)*	1.4*	*(0.2)*	0.7	*(0.1)*	1.4	*(0.2)*	0.9	*(0.2)*
> 3	2.0**	*(0.5)*	0.5	*(0.3)*	1.4	*(0.4)*	1.2	*(0.4)*	0.8	*(0.2)*	0.9	*(0.4)*
REGION (REFERENCE CLASS : NORTH EAST)												
NW	0.7	*(0.2)*	1.2	*(0.5)*	0.9	*(0.3)*	1.3	*(0.4)*	0.9	*(0.2)*	1.1	*(0.4)*
SE	0.9	*(0.2)*	1.1	*(0.5)*	1.3	*(0.4)*	0.9	*(0.4)*	1.3	*(0.4)*	0.9	*(0.4)*
SW	0.9	*(0.2)*	1.1	*(0.4)*	0.8	*(0.2)*	1.3	*(0.4)*	1.0	*(0.3)*	1.3	*(0.4)*
AES	1.1	*(0.2)*	1.4	*(0.3)*	0.9	*(0.1)*	0.9	*(0.1)*	0.9	*(0.1)*	1.1	*(0.2)*
INH	1.2	*(0.2)*	1.2	*(0.3)*	1.0	*(0.2)*	0.9	*(0.2)*	0.8	*(0.1)*	0.8	*(0.2)*
SUCC	2.1***	*(0.3)*	0.7	*(0.2)*	1.9***	*(0.3)*	0.4***	*(0.1)*	1.9***	*(0.3)*	0.6**	*(0.1)*
LFA	1.5	*(0.3)*	2.9*	*(1.4)*	0.9	*(0.3)*	4.1*	*(2.6)*	0.6	*(0.2)*	3.2	*(2.0)*
DAIRY	2.3**	*(0.7)*	2.6	*(1.6)*	1.6	*(0.6)*	3.6	*(2.7)*	0.9	*(0.3)*	2.8	*(2.0)*
Percent concordant			*74.6%*				*66.7%*				*64.1%*	
-2 log likelihood			*-1102.53*				*-1171.18*				*-1261.99*	
Likelihood ratio (LR)			*378.16****				*499.35****				*533.59****	
McFadden's R^2:			*0.146*				*0.176*				*0.175*	
Nagelkerke's R^2			*0.251*				*0.350*				*0.362*	
Cox and Snell R^2			*0.194*				*0.306*				*0.323*	

Standard errors in parentheses ** p<.05; ** p<.01; *** p<.001*

* Intentions to increase activity by 2020 relative to no intended change

^ Intentions to decrease activity by 2020 relative to no intended change

Table 6. Multinomial logistic regression model on land and labour intentions by 2020, relative risk ratios

	Employed labour				Family labour				Land			
	Increase[*]		*Decrease*[^]		*Increase*[*]		*Decrease*[^]		*Contracted In*[*]		*Rented Out*[^]	
PAST RESPONSE (REFERENCE CLASS : NO CHANGE)												
RDec	2.1[*]	*(0.6)*	6.0[***]	*(2.2)*	1.8	*(0.7)*	3.8[**]	*(1.6)*	4.2[***]	*(1.7)*	11.1[***]	*(6.2)*
Rinc	2.1[**]	*(0.4)*	4.0[***]	*(1.5)*	3.7[***]	*(0.8)*	2.1[*]	*(0.8)*	5.1[***]	*(1.3)*	5.6[***]	*(2.3)*
PAYMENT INCREASE (REFERENCE CLASS : NO CHANGE)												
PI-D	0.9	*(0.9)*	2.3	*(1.9)*	1.9	*(1.4)*	7.1[**]	*(4.5)*	0.6	*(0.6)*	3.6[***]	*(2.3)*
PI-I	4.2[***]	*(0.9)*	1.1	*(0.3)*	6.5[***]	*(1.4)*	2.0	*(0.7)*	6.8[***]	*(1.7)*	0.8	*(0.4)*
PAYMENT DECREASE (REFERENCE CLASS : NO CHANGE)												
PD-D	1.4	*(0.2)*	3.2[***]	*(0.9)*	1.1	*(0.3)*	2.9[***]	*(0.9)*	1.3	*(0.3)*	1.2	*(0.5)*
PD-I	2.1[***]	*(1.7)*	8.9	*(10.3)*	7.3[***]	*(3.1)*	4.0*	*(2.7)*	1.1	*(0.6)*	1.7	*(1.1)*
AGE (REFERENCE CLASS : <44)												
45-64	0.5[**]	*(0.1)*	1.9	*(0.9)*	0.8	*(0.2)*	0.8	*(0.3)*	0.6	*(0.2)*	3.6	*(2.0)*
65+	0.2[***]	*(0.1)*	3.2[*]	*(1.7)*	0.5*	*(0.2)*	0.9	*(0.5)*	0.4	*(0.2)*	5.8[*]	*(4.1)*
EDUC	1.2	*(0.3)*	1.2	*(0.3)*	1.1	*(0.2)*	1.2	*(0.3)*	1.2	*(0.3)*	0.6	*(0.2)*
MANAGEMENT STATUS (REFERENCE CLASS : OWNER)												
Ten	0.7	*(0.2)*	1.4	*(0.5)*	1.0	*(0.2)*	1.2	*(0.4)*	0.7	*(0.2)*	1.8	*(0.8)*
Mix	0.9	*(0.3)*	1.8	*(0.7)*	0.7	*(0.2)*	0.7	*(0.3)*	0.6	*(0.2)*	1.3	*(0.6)*
LABOUR EMPLOYED (REFERENCE CLASS : NONE)												
1-3	0.9	*(0.2)*	1.0	*(0.3)*	0.9	*(0.2)*	1.0	*(0.3)*	1.0	*(0.3)*	1.3	*(0.5)*
> 3	0.6	*(0.2)*	1.1	*(0.6)*	1.2	*(0.4)*	1.5	*(0.8)*	1.9	*(0.8)*	0.8	*(0.6)*
REGION (REFERENCE CLASS : NORTH EAST)												
NW	1.3	*(0.5)*	0.9	*(0.5)*	1.1	*(0.4)*	3.2	*(2.5)*	0.6	*(0.3)*	1.8	*(1.2)*
SE	1.1	*(0.5)*	0.6	*(0.4)*	1.5	*(0.6)*	2.0	*(1.7)*	0.8	*(0.3)*	1.3	*(1.0)*
SW	1.6	*(0.6)*	1.4	*(0.7)*	1.6	*(0.6)*	4.4	*(3.3)*	0.8	*(0.3)*	2.2	*(1.4)*
AES	1.2	*(0.2)*	0.9	*(0.3)*	1.2	*(0.2)*	0.8	*(0.2)*	1.5	*(0.4)*	0.5	*(0.2)*
INH	1.0	*(0.2)*	0.5[*]	*(0.2)*	0.8	*(0.2)*	0.8	*(0.3)*	1.1	*(0.3)*	0.9	*(0.3)*
SUCC	1.7[*]	*(0.3)*	0.4[**]	*(0.1)*	1.3	*(0.3)*	0.4[**]	*(0.1)*	1.2	*(0.3)*	0.4[**]	*(0.1)*
LFA	0.9	*(0.5)*	3.5	*(3.7)*	0.9	*(0.4)*	1.2	*(0.9)*	0.4[*]	*(0.2)*	1.0	*(0.7)*
DAIRY	2.1	*(1.1)*	5.5	*(6.0)*	0.6	*(0.3)*	1.2	*(1.0)*	0.5	*(0.3)*	1.2	*(1.1)*

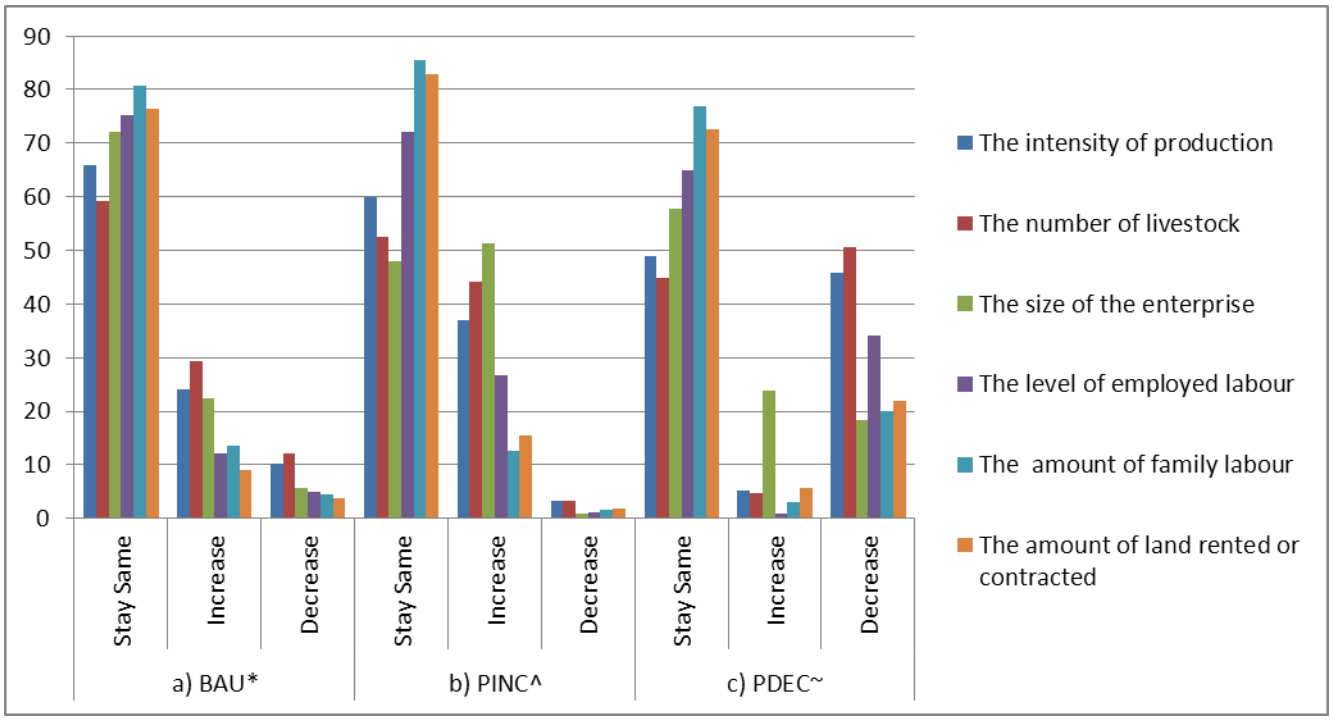
Percent concordant	*70.83%*	*76.97%*	*71.71%*
-2 log likelihood	*-1070.13*	*-957.68*	*-993.59*
Likelihood ratio (LR)	*380.55****	*333.86****	*388.02****
McFadden's R^2:	*0.151*	*0.148*	*0.163*
Nagelkerke's R^2	*0.289*	*0.268*	*0.300*
Cox and Snell R^2	*0.243*	*0.217*	*0.247*

Standard errors in parentheses * p<.05; ** p<.01; *** p<.001

* Intentions to increase activity by 2020 relative to no intended change
^ Intentions to decrease activity by 2020 relative to no intended change

Figure(s)

Figure 1. Sensitivities of change to payment scenarios, percentage sum by intention if a) Pillar 1 payments remain the same, b) Pillar 1 payments increase by 25%, c) Pillar 1 payments decrease by 25%



** BAU: Business as usual conditions, where present economic conditions and pillar 1 annual payments remain at 2013 levels*
^ PINC: Business as usual conditions, where present economic conditions stay the same, but pillar 1 annual payments increase by 25% on 2013 levels
~ PDEC: Business as usual conditions, where present economic conditions stay the same, but pillar 1 annual payments decrease by 25% on 2013 levels